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SOME DATA UPON THE RODENT APLDONTIA

By C. Andreson Hubbard.

The following data were gathered upon the campus of the University of Washington during the years 1917, 1918, 1919, and 1920. In the beginning the work was to cover only the breeding habits of this strictly western American rodent, Aplodontia, but a few months ago when these data were assembled for possible publication it was found that there was enough material for some forty other topics, among which are the historical aspect, the generic characteristics, range, environment, ^{abundance} sociability, voice, migration, enemies, parasites, sanitation, and the three main topics which I wish here to discuss, the breeding habits, the burrow system, and the feeding habits.

Aplodontiidae is one of the ten families embraced by the order Glires or Rodentia. The single genus Aplodontia, which was first described from the journal of Lewis and Clark by Rafinesque in 1817, contains the solitary species rufa. Today, this single species is subdivided into nine subspecies or races as follows: 1. A. rufa rufa; 2. A. rufa columbiana; 3. A. rufa olympica; 4. A. rufa rainierii; 5. A. rufa pacifica; 6. A. rufa humboldtiana; 7. A. rufa californica; 8. A. rufa nigra; 9. A. rufa phaea.

The generic characteristics of the animal are as follows: A stout-bodied, fossorial, crepuscular rodent, sometimes likened to a squirrel; head broad, flat, and blunt; neck short and thick; ears inconspicuous; eyes small; tail rudimentary; legs short, feet plantigrade, upper surface hairy, palms and soles naked, armed with well developed claws for digging; hair coarse, chestnut brown above, white or chestnut brown below; mammary glands six, teeth twenty-two in number, consisting of four incisors, no canines, two rudimentary pre-molars, which are superior, four pre-molars, twelve molars; body eleven to thirteen inches in length; weight up to four pounds.

The present range of the genus extends from the crest of the Cascade-Sierra Range west to the Pacific Ocean and from the Lower Fraser River in British Columbia south to the latitude of San Francisco Bay. The environment of the animal is varied. It generally inhabits damp wooded or jungle-like locations but is often found in dry vacant city lots. Locally the animal is known by the vernacular names of mountain beaver, mountain boomer, mole, marmot, kick willy, and a series of other inappropriate names.

Aplodontia is fossorial. The subterranean runways of the animal vary from three inches in diameter to shafts measuring from five to seven inches in height and six to ten inches in width. A greater portion of the burrow is within a foot of the surface. The burrows will, however, sink to depths of four feet. After much study on the burrow systems of Aplodontia, the author has divided the burrows into two types. These are the home or individual burrow and the communal burrow. The home burrow is that portion of the underground system which surrounds the nest. It is individual property. The communal burrows are those large well-defined, lined shafts which are used by all the animals of the community as common rights of way.

Both types of burrow systems are restricted by the composition of the soil through which the shafts are being driven and the contour of the land. If a limited piece of land is selected in which to drive shafts, the shafts will be much branched and compact. If, on the other hand, the land is broad and flat, the burrows will be spread out and very long. Aplodontia burrows most where digging is not difficult. He will however dig in clay of the stickiest type.

The communal runways were doubtless once individual burrows. Through the abandonment or death of the individual the galleries become the common property of the community members and are then traveled by all the animals of

Some Data upon the Rodent Aplodontia, (Cont.)

the community. The communal runways are very large, well-defined, long shafts which are usually uniform in cross section. They measure five to seven inches in height and from six to ten inches in width. They are generally within a foot of the surface. The interior of these runways suggests that they have been the ways of the colony for years. The interior is free from all loose earth. The sides are worn smooth and are packed tightly by the brushing past of generations of the animals. The floor is often packed solid with an inch of black substance which is probably debris carried in upon the feet of the animals. In some cases the flooring is black sand. This floor is packed so hard by the patting of myriads of feet that it can be taken up as if it were asphalt.

These communal ways connect each individual system. They lead to water, to favored feeding grounds and form a means of communication during the breeding season. No portion of these galleries is ever used for the purpose of securing roots for food. In some cases a continual stream of water runs through these ways. The walls have been packed so tight by the animals that the water does not readily wash them out. The author does not believe that the animals use these ways, because Aplodontia cares for water only as a drink. In the driving of these communal shafts, Aplodontia will at times take advantage of the shelter offered by a prostrate log and run his shaft the entire length beneath it. He will also use the protection afforded by a hollow log. The animal brings the shaft to the surface, runs an exposed path into the hollow of the log, runs his path through the entire length and sinks the shaft into the earth at the other end. Sometimes only a grass canopy covers the well-beaten terrestrial paths. Cave-ins in these ways do not bother the animals. The debris is cleared away and the ways are used as before.

The individual burrow is situated in a bank whenever possible. It is private property and is held against all intruders. If a steel trap is placed in one of these systems, but a single animal can be taken. After a week or so, however, the community members find the burrows unguarded and take possession. It is at the entrance of the individual burrows that the queer "hay stacks" are made. It is at certain of the entrances of these burrows that the house cleaning midden heaps may be found. It is in these systems that the cache chambers are uncovered and it is the individual portion of the Aplodontian burrows which are the highest developed. These systems may be divided into forage ways which the animal drives to obtain roots for food, and permanent ways. The forage ways are small tunnels only large enough for the individual to squeeze through. The walls are loose and there is no floor lining. No attempt is made to drain them. This type of tunnel is pushed forward until a root is encountered. When the appetite of the animal is satisfied it leaves, and this portion of the tunnel is forgotten until the animal accidentally falls upon it again. The permanent portion of the burrow leads from the nest to the outside world. These tunnels vary in depth from within a few inches of the surface to depths of four feet. The entire system is drained as if planned by human intelligence. The system is so arranged that no water stands in the runways, but runs down to lower levels where it accumulates in water traps. The tunneling is carried on with no ground plan and so resembles a labyrinth. The permanent portion of the individual burrow, like the communal burrow, is well-defined, smooth-walled and floored. The thickness of the paving varies with the age of the burrows. In cross-section these tunnels are slightly smaller than the communal ways.

The openings to the surface are of two types, the majority of them being simple, exposed openings. These usually widen at the mouth so the animal can dive into them from any angle up to 180 degrees in case of emergency.

Some Data upon the Rodent Aplodontia, (Cont.)

The majority of them are only openings from which to nose excavated earth. Definite openings are used in leaving and entering the system under ordinary conditions. The second type of opening is of queer arrangement. A verticle shaft is pushed up to the sod. The sod is then pierced by an opening only an inch in diameter. This small hole is concealed by overhanging grass. These openings may be for ventilation purposes or they may be only unfinished exits to the surface. While unearthing tunnels, chambers are now and then found. These chambers are from ten to twenty inches in diameter. These serve as caches and places for resting and eating.

The nest about which this type of burrow is wound is a large structure made up of inter-woven plant fibers. In dimensions it is twenty-four inches long, eighteen inches wide and fourteen inches high. These dimensions vary somewhat with the individual. The walls are about four inches thick and the entrance to the nest is toward the top.

The runways of Aplodontia are extended by means of the four well-developed claws found upon the fore feet. The earth is loosened with these fore claws and scratched under the abdomen and into the rear, dog-like. When a sufficient amount has been scratched loose the animal turns about and, with the nose, moves the earth toward the opening. When the earth is about to fall over the edge, the animal again turns about. It couches and sends the earth out into space by kicking the pile with the soles of the hind feet. The force is so great that the animal is carried out with the earth and is compelled to scramble back into the burrow.

Aplodontia is strictly herbivorous. The diet of the animal is composed of anything of the plant kingdom which is at all palatable. The chief food plants are sallal, sword ferns, and willow and alder bark. All food is taken to the burrow before eaten. Here it is probably eaten in the large chambers which resemble cache chambers. Of the willow and alder only the bark is eaten. The bark is peeled from the twigs in the same manner used by Castor. The sallal is nipped off close to the surface of the ground. Only the leaves of this plant are consumed. The uneaten materials are dropped and later thrown from the burrow system. The animal is often seen in daylight. Invariably he has been out on a foraging expedition and is seen shuffling toward his burrow with some delicacy between his teeth. All types of wild cane fruit stems, plants and roots have been noted in his possession at these times. During the fall great quantities of sallal are gathered together and placed in hay stack formation at the burrow entrances. In winter the diet seems to change. The favored sallal is neglected and the animal's attention is turned to collecting sword fern fronds. As many as seventy-five fronds may be found in a single hay stack. Dandelion roots are also unearthed and eaten during the winter. Although Aplodontia possesses a well-developed storage instinct, no food is stored for winter use. In captivity the animal will eat all variety of plants, roots, tubers, vegetable and cultivated fruits. He has an enormous appetite and it proves almost impossible to satisfy his hunger.

An insight into the breeding habits of Aplodontia was gained by the author by maintaining throughout the year a trap line consisting of a dozen number one steel traps placed at advantageous points along the communal subterranean galleries of the animal. It was early noted that the extent of the breeding season could not be determined by the female portion of the race because three of every four animals taken were males. This suggested the question, how could the breeding season be traced through the males of the race. The following method was adopted. It is universal that the testes of all male rodents enlarge to immense size during the breeding season. Aplodontiidae resembles the rest of the rodent families in this respect. So then, by observing the size of the testes as the seasons came and went, the breeding season could be traced.

Some Data upon the Rodent Aplodontia, (Cont.)

Aplodontia is unlike other mammals in the lack of the scrotum. For this reason it was necessary to kill all animals taken, open the abdominal cavity and examine the sex organs. Each pair of testes were taken from the animal, placed in a homeopathic vial and labeled for future reference. The testes of Aplodontia begin to increase in size about December 15. This date varies with climatic conditions and the age of the individual. Young males entering their first breeding season come to sexual activity a month later than mature animals. The testes increase in size from that of a large white bean, 12mm. long by 7 mm. diameter, to the size of the first joint of a man's thumb, 34mm. long by 16 mm. diameter. They attain their full size about January 15. The beginning of April finds the organs declining in size and by the middle of the month the organs are normal and the breeding season is over for the year.

During the year 1918, the first pregnant female was taken on February 26. The uterus contained two small embryos about the size of buck shot. The period of gestation is probably six or eight weeks. Young Aplodontias are born into the world about April 15. From pre-natal examination the author thinks twins are usually born, but in some cases three or even four young may be given birth to. During May many of the females taken are giving milk and the six mammal glands show all signs of being nursed. The first young animal observed by the author was found on May 28. The little animal, a perfect Aplodontia, was found dead upon the right of way of the Northern Pacific system, where it had been run down by a passing train. Aplodontia being unsocial, the family is cared for entirely by the mother.

Aplodontia does not breed until it is entering its third year. During the second year the foreskin so envelopes the penis that the males can not extend the organ for copulation. In immature females there seems to be a gristle plug situated at the head of the vagina which prevents the injection of semen. This plug also appears in mature females, but it is punctured by a tube which leads to each of the horns of the uterus.

There is no definite knowledge of the mating of Aplodontia. The author gives the following suggestions taken from his notes upon the subject. The season of sexual ardor is during the months of February and March. During this season three out of every four animals taken are males, which would suggest that the males seek out the females in their individual burrows or environment, where sexual intercourse takes place. The animal is probably promiscuous in his sex relations and is not confined to monogamy. It was noted, however, that a number of the females taken during the breeding season of the year 1918 were not pregnant. This may have been due to the fact that these females were robbed of their rightful mates by the jaws of the steel traps, and so remained unfertilized during the year. This would suggest possible monogamy.

The female generative apparatus of Aplodontia is typically rodent. The uterus is two horned. The Fallopian tubes are delicate and winding, and the vagina terminates in a gristle plug. This plug is punctured by two tubes which lead to the individual horns of the uterus. The urethra enters the vagina from below at about the mid point. The clitoris consists of a gristle-like, slender bone situated in the lining of the vagina very close to the external opening. The organ is stiff so not erectile. The ovaries are two in number.

The male of the genus differs from the majority of other mammals by the absence of the scrotum. The testes lie within the abdominal cavity, and when not sexually active are small and are comfortably roomed within. When, however, the breeding season arrives and the testes enlarge several times, the abdominal wall directly beneath the testes grows thin and elastic and the organs may be extended from or drawn into the abdominal

Some Data upon the Rodent Aplodontia, (Cont.)

cavity at will. There is always a thin elastic case of the wall about them. The penis of the animal is made up of a single stout bone which terminates in two circular knobs. The organ is not straight but curves downward slightly at the head. It is about 31 mm. in length in an adult animal. A foreskin protects the organ from external injury. The urethra extends down the middle of the organ and opens between the two terminal lobes which make up the head.

So we find Aplodontia to be fossorial, extending his long shafts beneath the surface. He is strictly herbivorous, eating anything from the plant kingdom which is palatable. His breeding season covers the two early spring months of February and March.

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A DAY (any January Day) IN THE FIELD AT PORTLAND, OREGON.

By Stanley G. Jewett.

It had been cold and rainy for a month, such a spell of weather as only those of us who live in the great northwest can fully appreciate. The sun had shown only for a few brief periods during this time, but the landscape was as green and fresh as it is on a June morning in any state east of the Mississippi, only the deep primeval forests of fir, spruce and hemlock had a dark and forboding look as the "Oregon Mist" drenched the land. On this particular morning we arose before dawn and after a hearty breakfast of "ham an'" we donned heavy boots, slicker and a sou'wester and hit the trail for Palatine Hill, a rather large, sloping scope of country just south of the city limits on the west bank of the Willamette River. Crossing the Sellwood Ferry we climbed the hill through Riverview Cemetary. Half way up the hill we stopped to visit with a flock of Western Evening Grosbeaks (Hesperiphona v. montana) as they hopped about on the ground gathering the fallen vine-maple seeds. While we watched this busy scene a troupe of those valuable insect destroyers so commonly met with in northern Oregon during the winter months came flitting through the trees. This troupe was made up of Oregon Chickadees (Penthestes a. occidentalis), Western Golden-crowned Kinglets (Regulus s. olivaceus), a few Chestnut-backed Chickadees (Penthestes r. rufescens), and while we watched, a couple of California Creepers (Certhia f. occidentalis) were noted pecking and prying into the bark crevices for insects, as they climbed the bole of a nearby Douglas Spruce; while on the dead lower limb of the same tree an Anthony's Vireo (Vireo h. obscurus) scolded us for intruding on such a hungry flock. In the grove of alders in the nearby canyon a Gairdner's Woodpecker (Dryobates p. gairdneri) busily pecked away on business such as only a woodpecker follows, that of ridding the forests of boring insects that sap the life of the trees. Passing on through an old apple orchard we saw several Varied Thrushes (Ixoreus n. naevius) busy eating the decaying fruit that littered the ground, while an occasional Northwestern Flicker (Colaptes c. saturator) startled from the same occupation, flew off to the nearby forest. Off to the left a lone Western Robin (Planesticus m. propinquus) sets moodily perched on a dead stub, while farther up the hill a Desert Sparrow Hawk (Falco s. phalaena) whiles away the time on another dead snag, his attitude giving us the impression that he wishes for bright sunny days when he can gorge himself on grasshoppers. Crossing a field we hear the cheerful song of